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B. Document Number: DOE/RL-2006-19, Rev. 0

C. Title: Sampling and Analysis Plan for Characterizing Groundwater in 200-West Area in Vicinity of Old Laundry Facility and T Plant

D. Internet Address

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ADMINISTRATIVE DOCUMENT PROCESSING AND APPROVAL

Sheet 1 of 1

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Document Number: DOE/RL-2006-19	Revision/Change Number: 0

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Sampling and Analysis Plan for Characterizing Groundwater in 200-West Area in Vicinity of Old Laundry Facility and T Plant

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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M. E. Byrnes
Fluor Hanford, Inc.

Date Published
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Assistant Secretary for Environmental Management

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CONTENTS

APPENDIX

TABLES

TERMS

AA	alternative action
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CLARC	*Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulation*
COC	contaminant of concern
CRDL	contract required detection limit
DFSNW	Duratek Federal Services Northwest
DQO	data quality objective
DR	decision rule
DS	decision statement
EPA	U.S. Environmental Protection Agency
FH	Fluor Hanford, Inc.
FY	fiscal year
GC	gas chromatography
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Document*
HEIS	Hanford Environmental Information System
MCL	maximum contaminant level
N/A	not applicable
OU	operable unit
QC	quality control
RI/FS	remedial investigation/feasibility study
SAP	sampling and analysis plan
SSPM	*Sampling Services Procedure Manual*
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System

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1.0 INTRODUCTION

This sampling and analysis plan (SAP) has been prepared to further refine the 200-ZP-1 Operable Unit (OU) conceptual site model. During implementation of the *Remedial Investigation/Feasibility Study Work Plan for the 200-ZP-1 Groundwater Operable Unit* (DOE-RL 2004), deep carbon tetrachloride contamination was identified in relatively high concentrations during the drilling of new groundwater monitoring wells 299-W13-1 and 299-W11-43, which are located east of the Old Laundry Facility and west of T Plant, respectively (Table 1-1, Appendix A Plate Map). Because the original purpose of well 299-W13-1 was to define the downgradient extent of the 5 ug/L carbon tetrachloride contour, the detection of carbon tetrachloride as high as 1,238 µg/L at a depth of 130.8 m (429 ft) below ground surface (bgs) indicated that the conceptual site model identified in the *Data Quality Objectives Summary Report Supporting the 200-ZP-1 Operable Unit Remedial Investigation/Feasibility Study Process* (FH 2003b) needed considerable refinement. While relatively high concentrations of carbon tetrachloride were anticipated in well 299-W11-43, the highest concentrations of carbon tetrachloride were expected to be encountered in the upper portion of the aquifer. Contrary to this, the results from depth-discrete groundwater samples collected from well 299-W11-43 (Table 1-1) showed high concentrations of carbon tetrachloride both in the upper portion and lower portion of the aquifer.

There has also been question over the distribution and extent of uranium contamination in groundwater in the vicinity of T Plant. Monitoring well 299-W11-37 is located due north of T Plant and has shown uranium concentrations as high as 454 ug/L, which is over 15 times the 30 ug/L drinking water standard. It is believe that this is a very localized problem, but this needs to be confirmed.

The borehole log from the drilling of wells 299-W13-1 and 299-W11-43 showed that the Lower Mud Unit of the Ringold Formation is discontinuous in places.

Table 1-1. Depth-Discrete Carbon Tetrachloride Concentrations.

Well Number	Sampling Depth (bgs)	Carbon Tetrachloride (µg/L)
299-W13-1	309	31.6
	349	163
	367	227
	403	1160
	429	1238
	458	643
	488	510
	527	132
299-W11-43	298	900
	328	980
	364	450
	418	321
	449	1,100

The updated conceptual site model presented in the *Data Quality Objectives Summary Report for Defining the Nature and Extent of Deep Groundwater Contamination in the 200-ZP-1 Operable Unit in the Vicinity of the Old Laundry Facility and T Plant* (FH 2005) takes into consideration the results from depth-discrete groundwater sampling performed during the installation of wells 299-W13-1 and 299-W11-43. However, due to the scarcity of wells in this portion of the OU, additional data are needed to verify whether the latest version of the conceptual site model is adequate to support the remainder of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial investigation/feasibility study (RI/FS) process. This SAP supplements the characterization work recently implemented in the 200-ZP-1 RI/FS work plan (DOE-RL 2004). See the work plan for a summary of the geology and hydrogeology of the 200 West Area and a summary of the major groundwater contamination sources (DOE-RL 2004).

This SAP contains five sections:

- Section 1.0 – Summarizes the recent data quality objectives (DQO) process output and the data needs.
- Section 2.0 – Provides the quality assurance project plan.
- Section 3.0 – Provides the field sampling plan.
- Section 4.0 – Provides the health and safety plan.
- Section 5.0 – Provides a list of the references cited.

1.1 CONTAMINANTS OF CONCERN

While Table 1-11 of FH (2003b) identifies 55 COCs for the 200-ZP-1 OU as a whole, a significantly smaller number of contaminants of concern (COCs) apply to the smaller study area being addressed by the more recent DQO process, which includes the area in the vicinity of the Old Laundry Facility and T Plant (FH 2005). This smaller list is identified in Table 1-2 and was derived from the review of the documents identified in Table 1-3. While the documents cited in Table 1-3 identified cobalt-60, cesium-137, radium-228, americium-241, plutonium-238, and plutonium-239/240 as being associated with process operations, these contaminants of potential concern were not included in the final list of COCs for the reasons stated in Section 1.10.1 of FH (2003b).

Table 1-2. Final List of Contaminants of Concern.

Media	COCs
Old Laundry Facility	
Groundwater	Carbon tetrachloride, nitrate, chloroform, fluoride, cadmium, lead, manganese, strontium-90, uranium, and dissolved oxygen[a].
T Plant	
Groundwater	Carbon tetrachloride, nitrate, uranium, hexavalent chromium, iodine-129, hydrogen-3, technetium-99, and dissolved oxygen[a].

[a] – Dissolved oxygen was added to assist the evaluation of current environmental conditions and is not a "contaminant."

COC = contaminant of concern

Table 1-3. Existing References. (5 sheets)

Reference	Summary
Liquid Effluent Study Final Project Report, WHC-EP-0367 (WHC 1990a)	<u>216-W-LC Crib (Laundry Crib)</u> The 218-W-LC Crib was constructed in 1981 to dispose wastewater from the Laundry Complex (2724-W). The 2724-W Laundry Complex was reported to consist of a series of buildings where soiled protective work clothing used on the Hanford Site was cleaned. Two-thirds of the clothing handled by the facility was radioactively contaminated. The decontamination station in the Mask Cleaning and Maintenance Facility is also connected to the crib, but operations there were only conducted during a 6-week demonstration project performed in October 1986. Potential contaminants of concern include chloroform, fluoride, cadmium, lead, manganese, cobalt-60, cesium-137, plutonium-239/240, radium-228, strontium-90, uranium (isotopes), americium-241, and plutonium-238. The total volume of effluent discharged to this crib from 1976 to 1988 was 1.58E+09 L. Average discharge rate from 1981 to 1989 varied from 5.2E+05 to 9.5E+05 gal/month. In 1990, the discharge rate was 2.61E+06 L/month. The calculated travel time for wastewater to reach the water table under average discharge conditions is 211 days. The calculated migration rate ranged from 34 cm/day for mobile constituents (e.g., chloroform, chromium, and fluoride) to several centimeters per day for less mobile contaminants (e.g., manganese, cobalt-60, and iron). <u>200-W Powerhouse Pond</u> Section 2-24 of this document presents information about liquid effluent discharges at the 200 West powerhouse pond, which is located approximately 0.3 mi west of the Laundry Building. The 200 West powerhouse pond has been used since 1984 to dispose liquid effluents from the 284-W power plant. The 284-W power plant produces steam for plant operations in conventional coal-fired boilers. Wastewater consists mainly of once-through cooling water used in the power plant. Other wastewater sources include boiler blowdowns and regenerated solutions from zeolite water softeners (approximately 9% sodium chloride). Power plant operations included three operating modes: routine operations, water softener, and regeneration and boiler blowdown. Analytical data indicate that all modes produce metallic ions and anions exceeding Group A study guidelines, with the predominant species being chloride. This document notes that several metals, in addition to chloride and fluoride in the effluent stream, discharged to this pond exceed Group A study guidelines. It concludes that the weighted-average concentrations of chloride and aluminum in pond water could impact groundwater quality. This document notes that the discharge rate to the pond is significantly less than natural recharge from Cold Creek and, therefore, no significant impact on the groundwater flow regime is expected. However, the discharge rate is sufficient for potential development of a perched water zone above the caliche layer.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
Liquid Effluent Study Final Project Report, WHC-EP-0367 (WHC 1990a) (cont'd)	The document notes that there are no data available on the total volume of effluent discharged to the pond. The average reported routine discharge rate was 1.23E+07 L/month; in addition to this was the softener regenerate that provided an additional 1.31E+07 L/month and blowdown that provided an additional 1.89E+05 L/month. Calculations estimate that wastewater would have reached the water table in 220 days. **216-T-4-2 Ditch** The 216-T-4-2 Ditch is located approximately 0.4 mi west-northwest of T Plant and was used to dispose wastewater from the T Plant Complex since 1972. The wastewater stream consisted of steam condensate, cooling water, and heating coil water from several buildings in the T Plant Complex. Aluminum and iron exceeded Group A study guidelines. The total volume of effluent discharged was 2.98E+08 L from 1972 to 1987. The maximum effluent discharge rate was 1.60E+06 L/month. It was reported that the current maximum effluent discharge rate is 1.60E+06 L/month. Calculations estimate that wastewater would have reached the water table in 279 days. **216-T-1 Ditch** The 216-T-1 Ditch was constructed in 1944 to dispose low-level radioactive liquid effluents from the head end of T Plant. The T Plant head end was used from 1945 to 1956 for fuel dissolution as part of spent fuel reprocessing. Discharges included steam condensate and cooling water. The T Plant head end was later converted to the T Plant Laboratory, which operated from 1964 to 1990. Wastewater from the ventilation system and floor washdowns may continue to be discharged to the 216-T-1 Ditch. The liquid effluent stream that disposed to the 216-T-1 Ditch is produced by facility drains, cooling systems, and steam condensate associated with laboratory activities and routine plant heating, ventilation, and air conditioning condensate. Calculations estimate that wastewater would have reached the water table in 607 days.
Liquid Effluent Study: Ground Water Characterization Data, WHC-EP-0366 (WHC 1990b)	This document presents the results from groundwater characterization performed to assess the presence of contamination in the immediate vicinity of liquid waste disposal sites. **200-W Powerhouse Pond** It was reported that because there are no groundwater monitoring wells in close proximity to the 200 West powerhouse pond, groundwater quality could not be evaluated. **216-T-4-2 Ditch** It was reported that because there are no groundwater monitoring wells in close proximity to the 216-T-4-2 Ditch, groundwater quality could not be evaluated. **216-T-1 Ditch** It was reported that because there are no groundwater monitoring wells in close proximity to the 216-T-1 Ditch, groundwater quality could not be evaluated.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
WIDS General Summary Report 216-U-14	216-U-14 Ditch was excavated in 1944 and was the original effluent route to the 216-U-10 Pond. It received powerhouse waste water, laundry waste water (until 1981) via 200-W-102 Pipeline, and steam condensate and cooling water from 221-U, 224-U and the 242-S Evaporator. Near the head end of the ditch, a 0.6 meter (2 foot) diameter pipe allowed 284-W Powerhouse and laundry effluent to flow under 19th Street and connect to the main portion of the ditch. The ditch also had a 1.22 meter (4 foot) diameter culvert that allowed effluent to flow under 16th Streeet to the portion of the ditch located north of the 242-S Evaporator and also flowed under Cooper Avenue to terminate at 216-U-10 Pond. The ditch is associated with the 284-W Powerhouse, 2723-W (old laundry facility), 2724-W (new laundry facility), 221-U, 224-U, 271-U the 242-S Evaporator building and the 241-U-110 tank. The 200 West Area Powerhouse Pond was constructed over the location of the head end of the 216-U-14 Ditch. The 200 West Area Powerhouse Pond was constructed over the location of the head end of the 216-U-14 Ditch after that section was deactivated. The 221-U and 224-U effluent entered the ditch after passing through the 207-U Retention Basin. The 216-U-16 Crib was built in 1984 to accept 224-U effluent that had previously been discharged to the ditch. However, the 216-U-16 Crib failed in 1985, when a pooling of waste on an underground caliche layer caused a lateral movement of the liquid that eventually reached groundwater by seeping around the well casing. Some 224-U effluent was diverted back to the 216-U-14 Ditch until November 1994, when the outlet pipe to the 207-U Retention Basin was permanently isolated and filled with concrete. The portion of the ditch located west of Cooper Avenue received effluent from the 242-S Evaporator and remained active until April 1995. Sediment, soil and vegetation samples were collected to characterize the 216-U-14 Ditch several times. In 1981, contamination levels found in sediment at the head end of the ditch, to a depth of 175 cm (70 inches), were above background levels for all radionuclides analyzed. The average concentration for all depths was 76.6 pCi/g Cs-137, 113.4 pCi/g Co-60, 101.6 pCi/g Sr-90, and 89.1 pCi/g Pu-239/240. The highest concentrations of Co-60 were found in the head end of the ditch. The highest concentration of Cs-137 was found near where the ditch entered U-Pond. Core samples were collected in 1987 to determine the effects of the accidental nitric acid and uranium release that occurred in 1986. A maximum of 185 pCi/g of uranium was found at a depth of 15 to 30 cm (6 to 12 inches). Test pits were excavated in the ditch in 1992 to support the Groundwater Impact Assessment for the 216-U-14 Ditch. The test pits were located in the portion of the ditch west of Cooper Avenue and east of the 216-U-10 Pond. Data indicated the contaminants were concentrated within a few feet of the bottom of the ditch.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
	Deactivation and stabilization for this site occurred in stages, beginning with the northern portion in 1984. The majority of the ditch had been backfilled and stabilized by 1995. The last portion to be eliminated was the portion located west of Cooper Avenue, where the ditch terminated into 216-U-10 Pond. It had been previously filled with large cobbles and continued to receive a small amount of effluent from 242-S until 1995. Although the effluent discharge ceased in 1995, this section was not downposted to Underground Radioactive Material status until 1997, when the cobbles were covered with "pit run" gravel. The laundry facility waste effluent was eliminated in 1981 and rerouted to a new crib (216-W-LWC). Discharge from the 224-U facility was eliminated in 1994. The portion of the ditch that received effluent from the 207-U Retention Basin was permanently isolated by filling the 207-U Retention Basin outlet pipe with concrete in 1994. The portion of the ditch from the 207-U Basin to the east side of Cooper Avenue was interim stabilized by Tank Farms Operations in January 1995. The remaining discharge portion of the ditch west of Cooper Avenue (receiving effluent from the 242-S Evaporator) was deactivated by capping the discharge pipe capped on April 11, 1995. Outlet valves leading to the 216-U-14 ditch are locked and tagged closed. This completes both the Tri-Party and DOE-RL Agreement milestones to cease discharge to the unit. On August 6, 1986, 2365 liters (625 gallons) of recovered nitric acid, containing 39 kilograms (86 pounds) of uranium was discharged through the chemical sewer to the 207-U Retention Basin. The acid released to the ditch was greatly diluted with the 1140 liter (300 gallon) per minut flow of cooling water from the 224-U facility being processed through the chemical sewer system.
WIDS General Summary Report 216-T-20	216-T-20 is a small concrete-block structure on the surface with a metal lid. It is located due west of the Old Laundry Facility. The site is an excavation, similar to a pit that was dug specifically to receive contaminated acid from the 241-TX-155 diversion box. No details on volume or potential contaminants are provided.
WIDS General Summary Report 299-W-13	This site is located west of the Old Laundry Facility. The site was used for regulated (i.e., containing radioactive material) vehicle maintenance and storage. No other pertinent details are provided.
WIDS General Summary Report 2607-W1	The 2607-W1 septic tank is constructed of reinforced concrete and receives sanitary wastewater and sewage. This system was constructed in 1994. There is a drain field associated with the system.
WIDS General Summary Report 200-W-64	This site is the Old Laundry Facility. The 200-W-64 site is the contaminated building foundation for 2724-W Laundry Facility. The laundry effluent was discharged via an underground pipeline to the 216-U-14 Ditch until being diverted to the new laundry waste crib (216-W-LWC) in 1981. Soiled protective work clothing was sent to the Laundry Facility from all Hanford Site work areas. Two-thirds of the laundry was radioactively contaminated. An average of 691,000 gallons of wastewater was discharged to the 216-W-LWC Crib each month.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
WIDS General Summary Report 216-W-LWC	This site is located just south of the Old Laundry Facility. The unit consists of two independent crib structures (drain fields) and associated underground pipelines connecting to the 200-W-64 Laundry Facilities. Soiled protective work clothing was sent to the Laundry Facility from all Hanford Site work areas. Two-thirds of the laundry was radioactively contaminated. An average of 2,615,000 L (691,000 gal) of wastewater was discharged to the 216-W-LWC Crib each month.
WIDS General Summary Report 200-W-53	This site is located west of T Plant. It was identified in 1994 as an area of surface soil contamination. Approximately 155,700 ft^2 of land was marked and posted as a "soil contamination area." The contaminated soil was scraped up and placed inside the 207-T retention basin.
WIDS General Summary Report 216-T-14, 216-T-15, 216-T-16, and 216-T-17	This site is located west of T Plant. Aged first-cycle supernate stored in the single-shell tanks was intentionally discharged to specific retention trenches during 1953 and 1954. The volume of liquid disposed to each trench was limited to 10% of the soil volume between the bottom of the trench and the groundwater table. T Plant used the bismuth-phosphate process to separate plutonium from irradiated fuel from 1944 through 1956. The first step was to dissolve the metal coating from the fuel rods. The next step dissolved the uranium and extracted the plutonium. The uranium was known as the metal waste stream, and it contained the bulk of the uranium and 90% of the cesium-137 and strontium-90. The plutonium went through two additional decontamination cycles to purify it, producing the first- and second-cycle waste streams. The 216-T-14 through 216-T-17 Trenches were surface stabilized in 1992.
WIDS General Summary Report 216-T-6	This site is located west of T Plant. The crib received liquid waste from the 221-T and 224-T Facilities via the 241-T-361 settling tank. This well (and others) was built to replace the 216-T-3 reverse well. From August 1946 to October 1946, the cribs received cell drainage from tank 5-6 in the 221-T Building and waste from the 224-T Building via the overflow from 241-T-361 settling tank. From 1946 to 1951, the site received cell drainage from tank 5-6 in the 221-T Building. In 1951, the 241-T-361 settling tank was deactivated and the 224-T Building effluent was re-routed to the 216-T-7 Crib. Plutonium was detected as deep as 20 ft below the bottom of the cribs and had spread out 45 ft laterally. The plutonium contamination measured 0.04 µg/kg of soil. The fission products measured 0.05µ g/kg of soil and had penetrated to a depth of 107 ft and spread laterally approximately 95 ft.
WIDS General Summary Report 200-W-88	This site is located southwest of T Plant and consists of two vitrified clay process sewer pipelines. The southern most process sewer line is a 24-in.-diameter, underground vitrified clay pipeline extending from the southern end of T Plant to the 207-T retention basin. The northern process sewer line is an 18-in.-diameter vitrified clay pipe that extends from the southern end of T Plant and bypasses the 207-T retention basin. It connects to the 207-T discharge pipe west of the retention basin. The process sewer lines transferred process cooling water, air conditioning condensate, and floor drain waste from 221-T, 224-T, and 242-T to the 207-T retention basin and the 216-T-4-1 and 216-T-4-2 Ditches. The retention basin released effluent to ditches that led to the 216-T-4-1 and 216-T-4-2 Ponds.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
WIDS General Summary Report 241-T-361	This site is located southwest of T Plant. The 241-T-361 settling tank is located southwest of the 221-T Building and north of 23rd Street and is adjacent to the 216-T-6 Cribs. The 241-T-361 settling tank received radioactive-contaminated liquid from the 221-T and 224-T Buildings. The tank discharged to the 216-T-3 reverse well during 1945 and 1946. When the reverse well was abandoned, the settling tank discharge was directed to the 216-T-6 Cribs. The 241-T-361 settling tank was deactivated in June 1951. This cylindrical tank is made of reinforced, pre-stressed concrete and is located underground for shielding purposes. A sludge sample collected in 1976 from the tank indicated 23 µg plutonium, 12 µCi/g strontium-90, and 676.6 µCi/g cesium-137. The liquid supernate sample contained 3.71 µCi/gal cesium-137 and 14.5 µg/gal plutonium.
WIDS General Summary Report 2607-W3	This site is located southwest of T Plant. The waste site is a septic tank that has been pumped, sampled, filled with sand, and abandoned in place.
WIDS General Summary Report 200-W-45	This site is located on the east side of T Plant. The waste site is a sand filter located near the northeast corner of 221-T, adjacent to the 291-T stack. The sand filter was used to filter air before going to the 291-T stack.
WIDS General Summary Report UPR-200-W-38	This unplanned release site is located to the west of T Plant. On December 30, 1955, the failure of an underground transfer line between the 241-TX-154 diversion box and 241-TX-302 catch tank flooded an area approximately 1,500 ft^2 in size with radioactive metal waste solution. Contamination spread during cleanup activities and increased in size to 4,000 ft^2. The incident report indicated that the volume of metal waste involved was "several thousand gallons."
WIDS General Summary Report UPR-200-W-2	This unplanned release site is located on the southeast corner of the 221-T Facility. In 1947, a cave-in occurred in an underground metal waste line. Gross soil contamination was found 10 ft below the surface, confirming the presence of one or more leaks in the underground process piping.
WIDS General Summary Report 200-W-80	This site is located west of T Plant. In May 2000, the Dyncorp Integrated Soil, Vegetation, and Animal Control Group submitted the mound of soil with contamination area posting to the WIDS database as a discovery site. No contamination was identified on the surface of the mound at the time. It is possible that the mound was created during parking lot expansion at T Plant.
WIDS General Summary Report 216-T-11	This site is located west of T Plant. The site consists of a backfilled trench that was used for subsurface liquid disposal of heavy equipment and vehicle decontamination waste. This site is associated with the 216-T-9 and 216-T-10 Trenches. The unit operated between June 1951 and March 1954, and in 1954, the unit was backfilled. Decontamination operations were then transferred to the 269-W Garage Facility, which then discharged to the 216-T-13 Trench.
WIDS General Summary Report 216-T-10	This site is located west of T Plant, west of the 221-T Building, and southwest of the 216-T-33 Crib. The site consists of a backfilled trench. The site is associated with 216-T-9 and 216-T-11 trenches and it was used for subsurface liquid disposal of heavy equipment and vehicle decontamination waste. The unit operated between June 1951 and March 1954. In 1954, the unit was backfilled, and decontamination operations were transferred to the 269-W Garage Facility, which then discharged to the 216-T-13 Trench.

Table 1-3. Existing References. (5 sheets)

Reference	Summary
WIDS General Summary Report 216-T-9	This site is located west of T Plant and consists of a backfilled trench. The site is west of the 221-T Building and southwest of the 216-T-33 Crib. The site is associated with 216-T-10 and 216-T-11 Trenches and it was used for subsurface liquid disposal of heavy equipment and vehicle decontamination waste. The unit operated between June 1951 and March 1954. In 1954, the unit was backfilled, and decontamination operations were transferred to the 269-W Garage Facility, which discharged to the 216-T-13 Trench.
WIDS General Summary Report 216-T-33	This site is located northwest of T Plant. This site consists of a rectangular crib with perforated vitreous clay inlet pipe set into a gravel layer. Layers of plastic sheeting, clean sand, and backfill are above the pipe. The site provided liquid disposal for the 2706-T Building. After the line plugged, 2706-T waste was routed to the 216-T-28 Crib via the 241-T112 tank.
WIDS General Summary Report UPR-200-W-73	This site is located north of T Plant. On October 16, 1974, contamination was spread from a leaking multi-purpose transfer box. During a routine survey in the 221-T Building tunnel, contamination levels up to 3,800 millirad/hr were detected on the bed of the multi-purpose transfer box railroad car. When the railroad car was moved to the 2706-T Building, contamination spread. Spots of contamination up to 40 millirad/hr were counted. The cause of the leakage was migration of decontamination solution to the hairline crack area and subsequent leaking when the railcar was moved.

WIDS = Waste Information Data System

1.2 DATA QUALITY OBJECTIVES

The U.S. Environmental Protection Agency's (EPA's) *Guidance for the Data Quality Objectives Process* (EPA 2000) was used to support the development of this SAP. The DQO process is a strategic planning approach for defining the criteria that a data collection design should satisfy. The DQO process is used to ensure that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application.

This section presents only a summary of the key outputs resulting from the DQO process. For additional details, refer to the DQO summary report (FH 2005).

1.2.1 Statement of the Problem

The problem is that carbon tetrachloride contamination was detected in relatively high concentrations deep within the unconfined aquifer on the east side of the 200 West Area, near the Old Laundry Facility and just west of T Plant. The distribution of the deep carbon tetrachloride plume both upgradient and downgradient of the area between U Plant and T Plant needs to be better understood. The distribution of uranium contamination in the vicinity of well 299-W11-37 also needs to be better understood. Data collected in support of this DQO will either confirm or reject the conceptual site models presented in Section 1.12 of the DQO summary report (FH 2005) are accurate.

1.2.2 Decision Statements and Decision Rules

The decision statements (DSs) consolidate potential questions and alternative actions (AAs). Decision rules (DRs) are generated from the DSs. A DR is an "IF...THEN..." statement that incorporates the parameter of interest, unit of decision making, action level, and action(s) that

would result from resolution of the decision. Tables 1-4 and 1-5 present the DSs and DRs identified in the DQO summary report (FH 2005).

Table 1-4. Decision Statements. (2 sheets)

DS #	Decision Statement
1	[a]
2	Determine whether or not large-volume water discharges to the 216-W-LC Crib (Laundry Crib), 200 West powerhouse pond, and surrounding ditches and trenches have caused the carbon tetrachloride contamination in the vicinity of the Old Laundry Facility to be most concentrated near the base of the unconfined aquifer; if so, verify that water discharge practices and aquifer conditions in the 200 West Area have changed to prevent carbon tetrachloride contamination from being driven deeper within aquifer; if not, no action is required.
3	Determine whether or not the carbon tetrachloride plume both upgradient and downgradient of the area between U Plant and T Plant is most concentrated near the base of the unconfined aquifer, as the current conceptual site model suggests; if not, update the conceptual site model to reflect the correct distribution of carbon tetrachloride.
4	Determine whether or not the carbon tetrachloride plume both upgradient and downgradient of T Plant is most concentrated near the middle and base of the unconfined aquifer, as the current conceptual site model suggests; if not, update the conceptual site model to reflect the correct distribution of carbon tetrachloride.
5	Determine whether or not the carbon tetrachloride plume in the vicinity of the Old Laundry Facility will continue to migrate deeper within the unconfined aquifer; if so, estimate the vertical rate of carbon tetrachloride migration within the unconfined aquifer and consider implementing additional interim remedial action now to prevent further migration; if not, wait until the completion of the CERCLA RI/FS process prior to implementing any additional remedial action.
6	Determine whether or not the downgradient extent of deep groundwater contamination extends between and beyond the Old Laundry Facility and T Plant, thus requiring the current conceptual site model to be updated and risk modeling inputs to be re-assessed; otherwise, no action is required.
7	Determine whether or not chloroform concentrations are mirroring or mimicking carbon tetrachloride concentrations with depth within the aquifer, which shall provide a reflection of natural degradation processes that should be taken into consideration in the FS.
8	Determine the vertical and horizontal extent of the uranium contamination in the unconfined aquifer in the vicinity of T Plant and update the current conceptual site model as needed.
9	Determine if any of the COCs identified in Table 1-2 are present in groundwater in concentrations exceeding the selected limit presented in Table 1-7 in the vicinity of the Old Laundry Facility and T Plant and, therefore, should be added to the routine groundwater monitoring program.

[a] The data quality objectives summary report (FH 2005) identified that data already exist to resolve this DS.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DS = decision statement
RI/FS = remedial investigation/feasibility study

Table 1-5. Decision Rules. (2 sheets)

DS #	DR #	Decision Rule
1	1	[a]

Table 1-5. Decision Rules. (2 sheets)

DS #	DR #	Decision Rule
2	2	If the maximum concentration of carbon tetrachloride in groundwater is found near the base of the unconfined aquifer in the vicinity of the 216-W-LC Crib (Laundry Crib), 200 West powerhouse pond, and surrounding ditches and trenches, then verify that water discharge practices and aquifer conditions in the vicinity of the surrounding cribs, trenches and ponds have changed to prevent carbon tetrachloride contamination from being driven deeper within the aquifer; otherwise no action is required.
3	3	If the maximum concentration of carbon tetrachloride in groundwater both upgradient and downgradient of the area between U Plant and T Plant is found at the base of the unconfined aquifer, then no action is required; otherwise update the conceptual site model to reflect the correct distribution of carbon tetrachloride.
4	4	If the maximum concentration of carbon tetrachloride in groundwater both upgradient and downgradient of T Plant is found near the middle and base of the unconfined aquifer, then no action is required; otherwise update the conceptual site model to reflect the correct distribution of carbon tetrachloride.
5	5	If the results from water-level measurements suggest that there is a downward gradient with depth in the unconfined aquifer, then estimate the rate of carbon tetrachloride vertical migration and consider implementing additional interim action now to prevent further migration; otherwise wait until the completion of the CERCLA RI/FS process prior to implementing any additional remedial action.
6	6	If deep carbon tetrachloride contamination extends between and beyond the Old Laundry Facility and T Plant, then update the conceptual site model and risk modeling inputs; otherwise no action is required.
7	7	If concentrations of chloroform are found to be mirroring carbon tetrachloride concentrations with depth within the unconfined aquifer, then it will be confirmed that carbon tetrachloride is naturally degrading; otherwise if concentrations of chloroform are found to mimick the carbon tetrachloride concentrations with depth, then it will be confirmed that little or no natural degradation is occurring.
8	8	If the maximum concentration of uranium detected in groundwater both upgradient and downgradient of monitoring well 299-W11-37 is above 30 µg/L, then the conceptual site model will be updated to accurately reflect the extent of uranium contamination; otherwise no action is required.
9	9	If the maximum concentration of one or more of the COCs in Table 1-2 exceed the selected limit presented in Table 1-7 then add the wells exceeding the limit to the routine monitoring program; otherwise no action is required.

[a] The data quality objectives summary report (FH 2005) identified that data already exist to resolve this DS.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC = contaminant of concern
DR = decision rule
DS = decision statement
RI/FS = remedial investigation/feasibility study

1.2.3 Error Tolerance and Decision Consequences

Using standard statistical methods to identify the number of wells required to be installed to address the principal study questions would be cost prohibitive due to the great depth to groundwater in the 200 West Area (greater than 61 m [200 ft]). As a result, professional judgment was used to select the number and location of new groundwater wells, as well as the number of depth-discrete groundwater samples to be collected during the installation of each well. As

a result, many of the tables in Step 6 of the DQO process were not completed because they apply only to statistical sampling designs.

1.3 SUMMARY OF DATA QUALITY OBJECTIVE RESULTS (SAMPLING DESIGN)

This section presents a summary of the supplemental data that were identified as needed to address all of the decisions identified in the DQO summary report (FH 2005). The supplemental data include the installation of five new groundwater monitoring wells in the vicinity of the Old Laundry Facility and T Plant that will allow the required analytical data to be collected to address all of the DSs identified in Table 1-4.

The plate map provided in Appendix A shows the location of the five proposed new groundwater wells. These five new wells will all be constructed using 6-in.-diameter casing so they could at some time be converted into extraction wells. Table 1-6 summarizes the data required to resolve each DS, the number and location of monitoring wells required to be installed to collect this data, the number of depth-discrete groundwater samples to be collected from each well, and the analyses to be performed on individual groundwater samples.

Table 1-7 identifies the selected target limit (action level) for each of the COCs and the contract-required detection limit (CRDL). Table 1-8 presents the selected analytical method that will meet the CRDLs and the analytical performance requirements.

Table 1-6. Information Required to Resolve the Decision Statements. (4 sheets)

DS #	Required Data/Number of New Wells To Be Installed	Number of Samples/ Measurements	Survey/Analytical Methods
1	*	*	*
2	One new deep well (AA) to be installed in the vicinity of the 200 West powerhouse, 216-U-14 Trench, and surrounding ditches and trenches (see plate map in Appendix A).	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from new deep well (AA) (estimated 7 samples). Well (AA) will be screened across the interval showing the highest carbon tetrachloride concentrations.	Field gas chromatography for carbon tetrachloride analysis
3	Total of five new deep wells to be installed: • One upgradient deep well (AA) to be drilled in the vicinity of the 200 West powerhouse, 216-U-14 Trench, and surrounding ditches and trenches (same as installed for DS #2). • One downgradient deep well (BB) to be drilled downgradient of the Old Laundry Facility (near the northeast corner of WSCF) (see plate map in Appendix A). • One deep downgradient well (CC) to be installed approximately 1,000 ft northeast of T Plant (see plate map in Appendix A) • One deep cross-gradient well (DD) to be installed cross-gradient of the Old Laundry Facility, adjacent to well 299-W11-10 (see plate map in Appendix A). Well DD will be set to screen the lower portion of the unconfined aquifer (see DS #5). • One deep cross-gradient well (EE) to be installed between U Plant and the Old Laudry Facility (see plate map in Appendix A).	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from each of the five new deep wells (AA, BB, CC, DD, and EE) (estimated 40 samples). Note that eight of these groundwater samples are the same as those being collected to address DS #2. All of these wells will be screened across the interval showing the highest carbon tetrachloride concentration, except well (DD) which must be set to screen the lower portion of the unconfined aquifer.	Field gas chromatography for carbon tetrachloride analysis. DS #8 also requires samples from well (CC) to be analyzed for uranium using Inductively Coupled Plasma/Mass Spectrometry (ICP-MS) (PNNL 1998).

Table 1-6. Information Required to Resolve the Decision Statements. (4 sheets)

DS #	Required Data/Number of New Wells To Be Installed	Number of Samples/ Measurements	Survey/Analytical Methods
4	One new well to be installed downgradient of T Plant (CC) (same as installed for DS #3). Recently installed well 299-W11-43 will serve as the upgradient well for T Plant from which depth-discrete groundwater samples were collected for carbon tetrachloride analysis in FY05.	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from downgradient well (CC) (estimated 8 samples). Note that these eight groundwater samples are the same as those being collected to address DS #3. Well (CC) will be screened across the interval showing the highest carbon tetrachloride and/or uranium (see DS #8 below) concentrations.	Field gas chromatography for carbon tetrachloride analysis
5	One new deep screened well (DD) to be installed immediately adjacent to existing shallow-screened well 299-W11-10. (same as installed for D5 #3)	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from one new deep well (DD) (estimated 8 samples). Note that these eight groundwater sample are the same as those being collected to address DS #3. Well (DD) will be set to screen the lower portion of the unconfined aquifer.	Field gas chromatography for carbon tetrachloride analysis Water-level measurements using water-level probe
6	Total of four new deep wells to be installed: • One deep downgradient well (BB) to be installed near the northeast corner of WSCF (same as installed for DS #3 above). • One deep downgradient well (CC) to be installed approximately 1,000 ft northeast of T Plant (same as installed for DS #3 above). • One deep cross-gradient well (DD) to be installed cross-gradient of the Old Laundry Facility, adjacent to well 299-W11-10 (same as installed for DS #5 above). • One deep cross-gradient well (EE) to be installed between U Plant and the Old Laundry Facility (same as installed for DS #3).	Depth-discrete groundwater samples collected at 25 ft intervals throughout the unconfined aquifer from each of four new deep wells (BB, CC, DD, and EE) (estimated 32 samples). Note that 32 of these groundwater samples are the same as those being collected to address DS #3, 4, and 5 above. Wells will be screened across interval showing highest carbon tetrachloride concentrations, except for the well being installed adjacent to well 299-W11-10, which must be completed near the base of the unconfined aquifer to address DS #5.	Field gas chromatography for carbon tetrachloride analysis

Table 1-6. Information Required to Resolve the Decision Statements. (4 sheets)

DS #	Required Data/Number of New Wells To Be Installed	Number of Samples/ Measurements	Survey/Analytical Methods
7	Total of three new deep wells to be installed: • One drilled in the vicinity of the 200 West powerhouse, 216-U-14 Trench, and surrounding ditches and trenches (AA) (same as new well described in DS #2 and 3, above). • One drilled downgradient of T Plant (CC) (same as downgradient well described in DS #3, 4 and 6 above). • One drilled between U Plant and the Old Laundry Facility (EE) (same as cross-gradient well described in DS #3, and 6 above).	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from each of three new deep wells (AA, CC, and EE) (estimated 24 samples). Note that all 24 of these groundwater samples are the same as those being collected to address DS# 2, 3, 4, and 6. Wells will be screened across interval showing highest carbon tetrachloride (and/or uranium for well CC, see DS #8 below) concentrations.	Field gas chromatography for carbon tetrachloride and chloroform analysis
8	Total of one new deep well (CC) to be installed downgradient of T Plant (same as downgradient well described in DS #3, 4, 6, and 7 above). Existing wells 299-W11-43 and 299-W11-37 shall be sampled to help define horizontal distribution of uranium contamination.	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from new deep well (CC) (estimated 8 samples). Note that these eight groundwater samples are the same as those being collected to address DS #3 4, 6, and 7. One groundwater sample is to be collected from existing wells 299-W11-43 and 299-W11-37 to support define horizontal distribution of uranium contamination.	Inductively coupled plasma/mass spectrometry (ICP-MS) (PNNL 1998) for uranium analysis

Table 1-6. Information Required to Resolve the Decision Statements. (4 sheets)

DS #	Required Data/Number of New Wells To Be Installed	Number of Samples/ Measurements	Survey/Analytical Methods[a]
9	Total of five new deep wells to be installed: • One deep well (AA) drilled in the vicinity of the 200 West powerhouse, 216-U-14 Trench, and surrounding ditches and trenches (same as new well described in DS #2, 3, and 7 above). • One deep downgradient well (BB) to be installed near the northeast corner of WSCF (same as installed for DS #3 and 6 above). • One deep downgradient well (CC) to be installed approximately 1,000 ft northeast of T Plant (same as installed for DS #3, 4, 6, 7, and 8 above). • One deep cross-gradient well (DD) to be installed north of the Old Laundry Facility, adjacent to well 299-W11-10 (same as installed for DS #3, 5, and 6 above). • One deep cross-gradient well (EE) to be installed between U Plant and the Old Laundry Facility (same as installed for DS#3, 6, and 7 above).	Depth-discrete groundwater samples collected at 25 ft intervals throughout unconfined aquifer from each of five new deep wells (AA, BB, CC, DD, and EE) (estimated 40 samples). Note that all 40 of these groundwater samples are the same as those being collected to address earlier DSs. Wells will be screened across interval showing highest carbon tetrachloride concentrations, except for the well being installed adjacent to well 299-W11-10, which must be completed near the base of the unconfined aquifer to address DS #5.	All groundwater sampling intervals to be analyzed using field gas chromatography for caron tetrachloride and onsite analysis for TC-99 and dissolved oxygen. As many as five[b] groundwater sampling intevals from each borehole shall also be analyzed for all the analytical methods identified in Table 1-8.

[a] Because Table 3-1 identified that data already exist to resolve this DS, there is no need to complete this table for this DS.

[b] The five sampling intervals should be approximately 20, 70, 120, 170, and 220 feet below the water table.

DS = decision statement
FY = fiscal year
WSCF = Waste Sampling and Characterization Facility

In addition to the sampling identified in Table 1-6 above, as many as three vapor samples shall be collected from the vadose zone during the drilling of new wells AA, DD, and EE. These samples shall be analyzed for carbon tetrachloride using field gas chromatography. The sampling intervals are (1) approximately 0 to 5 ft above the Cold Creek Unit; (2) approximately 0 to 5 ft below the Cold Creek Unit; and (3) approximately 5 ft above the water table. See Table 1-8 for analytical performance requirements.

Table 1-7. Preliminary Target Action Levels and Basis for Groundwater Contaminants of Concern. (2 sheets)

COC	Primary MCL	Secondary MCL[a]	CLARC 3.1 Groundwater Method B[c]	Background[b]	CRDL	Selected Limit[d] (Action Level)	Source[d]	Comments
Volatile Organics – Units for Nonradiological COCs (µg/L)								
Carbon tetrachloride	5	—	0.337	—	3	3	CRDL	CRDL > CLARC. CERCLA COC in current groundwater well monitoring network.[d]
Chloroform	—	—	7.17	—	5	7.17	CLARC	CLARC < MCL and CLARC > CRDL. CERCLA COC in current groundwater well monitoring network.[d]
Metals – Units for Nonradiol4ogical COCs (µg/L)								
Cadmium	5	—	8	<10	5	5	Primary MCL[e]	MCL < CLARC, and MCL = CRDL. CERCLA COC in current groundwater well monitoring network.[d]
Chromium (hexavalent)	—	—	48[b]	—	10	48	CLARC	CLARC > CRDL. There is no drinking water MCL for hexavalent chromium.
Lead	15	—	—	<5	10	15	Primary MCL[e]	MCL > CRDL. Drinking water treatment levels = 15 µg/L (http://www.epa.gov/ safewater/mcl.html).
Manganese	—	50	2,240	24.5	5	50	Secondary MCL	CLARC > CRDL. Secondary drinking water standard = 50 µg/L (http://www.epa.gov/ safewater/mcl.html).
Uranium	30	—	48	3.43	0.1	30	Primary MCL[e]	MCL < CLARC
Non-Metals – Units for Nonradiological COCs (µg/L)								
Nitrate	44,285	—	7,086	12,400	75	12,400	Background	Background > CLARC and CRDL.
Nitrate as nitrogen	10,000	—	1,600	2,800	17	2,800	Background	Background > CLARC and CRDL.
Fluoride	4,000	2,000	—	775	500	4,000	Primary MCL[e]	Primary MCL > background and CRDL. Secondary drinking water standard is unenforceable and other standards are available.

Table 1-7. Preliminary Target Action Levels and Basis for Groundwater Contaminants of Concern. (2 sheets)

COC	Primary MCL	Secondary MCL[a]	CLARC 3.1 Groundwater Method B[e]	Background[b]	CRDL	Selected Limit[d] (Action Level)	Source[d]	Comments
Radiological COCs –Units for Radiological COCs (pCi/L, unless otherwise noted)								
I-129	1[a]	—	—	—	0.5	1[a]	Primary MCL[a]	MCL > CRDL. MCL based on 4 mrem/yr. CERCLA COC in current groundwater well monitoring network.[d] From http://www.epa.gov/safewater/mcl.html (EPA et al. 1995).
Sr-90	8[a]	—	—	—	2	8[a]	Primary MCL[a]	MCL > CRDL. MCL based on 4 mrem/yr. CERCLA COC in current groundwater well monitoring network.[d] From http://www.epa.gov/safewater/mcl.html (EPA et al. 1995).
Tc-99	900[a,c]	—	—	—	20	900[a]	Primary MCL[a]	MCL > CRDL. MCL based on 4 mrem/yr. CERCLA COC in current groundwater well monitoring network.[d] From http://www.epa.gov/safewater/mcl.html (EPA et al. 1995).
H-3	20,000[a]	—	—	—	400	20,000[a]	Primary MCL[a]	MCL > CRDL. MCL based on 4 mrem/yr. From http://www.epa.gov/safewater/mcl.html (EPA et al. 1995).
Cs-137	60[a]	—	—	—	15	60[a]	MCL[a]	CERCLA COC in current groundwater well monitoring network.[d]

[a] Target action level based on the estimated groundwater concentration that would result 4 mrem/yr (MCL) to the whole body or an organ if the groundwater water were used as drinking water (DOE-RL 2002, Table 2-3).

[b] *Washington Administrative Code* (WAC) 173-340-740(4) groundwater Method B values from Washington State Department of Ecology's *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulation (CLARC III)*, Section 3.1 tables (Ecology 2001).

[c] Technetium-99 remedial target action levels defined in the *Record of Decision for the 200-ZP-1 Interim Remedial Measure* (EPA et al. 1995).

[d] From *Data Quality Objectives Summary Report for Establishing a RCRA/CERCLA/AEA Integrated 200 West and 200 East Groundwater Monitoring Network* (FH 2003a).

[e] Target action level represents primary MCL (from web site http://www.epa.gov/safewater/mcl.html).

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC = contaminant of concern
CRDL = contract-required detection limit
MCL = maximum contaminant level

Table 1-8. Analytical Performance Requirements. (2 sheets)

DS #	COCs	Survey/ Analytical Method	Selected Limit (Action Level)	CRDL	Precision Requirement	Accuracy Requirement
1	a	a	a	a	a	a
2, 3, 4, 6, and 7	Carbon tetrachloride, chloroform[b]	Onsite field GC	3 µg/L, 7.17 µg/L[b]	3 µg/L, 7.17 µg/L[b]	±25% ±25%	75-125% 75-125%
		SW-846, Method 8260	3 µg/L, 7.17 µg/L[b]	3 µg/L, 7.17 µg/L[b]	±25% ±25%	75-125% 75-125%
5	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]	N/A[c]
8	Uranium[e]	Inductively coupled plasma/mass spectrometry (ICP-MS) (PNNL 1998)	30 µg/L	0.05 µg/L	±25%	75-125%
		Kinetic phosphorescence or 200.8	30 µg/L	1 µg/L	±30%	70-130%
9	All COCs listed in Table 1-2	SW-846 Method 8260:				
		Carbon tetrachloride	3 µg/L	3 µg/L	±25%	75-125%
		Chloroform	7.17 µg/L	7.17 µg/L	±25%	75-125%
		Method 7196A:				
		Hexavalent chromium	48 µg/L	48 µg/L	±25%	75-125%
		Method 6010-B or 200.8			±25%	75-125%
		Cadmium	5 µg/L	5 µg/L	±25%	75-125%
		Manganese	50 µg/L	50 µg/L		
		Method 6010-B (trace) or 200.8				
		Lead	15 µg/L	15 µg/L	±25%	75-125%
		Kinetic phosphorescence or Method 200.8				
		Uranium	30 µg/L	30 µg/L	±30%	70 – 130%

Table 1-8. Analytical Performance Requirements. (2 sheets)

DS #	COCs	Survey/ Analytical Method	Selected Limit (Action Level)	CRDL	Precision Requirement	Accuracy Requirement
		Method 300.0 Nitrate Fluoride	12,400 µg/L 4,000 µg/L	12,400 µg/L 4,000 µg/L	±25% ±25%	75-125% 75-125%
		Gas proportional counting Sr-90	8 pCi/L	8 pCi/L	±30%	70 – 130%
		Low-energy photon spectroscopy I-129	1 pCi/L	1 pCi/L	±30%	70 – 130%
		Liquid scintillation H-3 Tc-99	20,000 pCi/L 900 pCi/L	20,000 pCi/L 900 pCi/L	±30% ±30%	70 – 130% 70 – 130%
Supplementary Vapor Sampling[f]	Carbon Tetrachloride	Field screening gas chromatography	1 ppmv	1 ppmv	±25%	75 – 125%
[a]	Dissolved Oxygen	Method 360.1 Oxygen_FLD	[h]	0.1 mg/L	±30%	±0.2 mg/L

[a] The data quality objectives summary report (FH 2005) identified that data already exist to resolve this DS.
[b] Only applies to DS #7.
[c] Does not apply because measuring vertical gradients only requires the collection of water-level elevation.
[d] Precision and accuracy requirements shall be in accordance with SW-846 requirements (EPA 1997).
[e] Pacific Northwest National Laboratory field analysis will be for uranium-238 as opposed to total uranium. The 0.05 µg/L CRDL refers to uranium-38.
[f] Soil vapor samples being collected to support vadose zone project.
[g] EPA requested dissolved oxygen be run on all depth-discrete groundwater samples after the DQO process had been completed.
[h] There is no action level for dissolved oxygen.

COC = contaminant of concern
CRDL = contract-required detection limit
DS = decision statement
GC = gas chromatography
N/A = not applicable

2.0 QUALITY ASSURANCE PROJECT PLAN

This section identifies the individuals or organizations participating in the project and discusses specific roles and responsibilities. The quality objectives for measurement data and the special training requirements for staff performing the work are also documented.

2.1 PROJECT MANAGEMENT

The following subsections address the basic areas of project management and will ensure that the project has a defined goal, the participants understand the goal and the approach to be used, and the planned outputs have been appropriately documented.

2.1.1 Project/Task Organization

Fluor Hanford, Inc. (FH), or its approved subcontractor, will be responsible for collecting, packaging, and shipping groundwater samples to the laboratory. FH will select a laboratory to perform the analyses; the laboratory selected must conform to Hanford Site laboratory procedures, or their equivalent as approved by the U.S. Department of Energy, Richland Operations Office; EPA; and the Washington State Department of Ecology. FH is responsible for managing all interfaces among subcontractors involved in executing the work described in the work plan and SAP.

2.1.2 Quality Objectives and Criteria for Measurement Data

Regarding analytical methods, the detection limits and the precision and accuracy requirements for each analysis to be performed are summarized Table 1-8. For sampling, procedures from either FH or its subcontractor, Duratek Federal Services Northwest (DFSNW), will be used. Should a different subcontractor be selected, equivalent and reviewed procedures will be used. This applies to all FH or DFSNW procedures identified in this SAP.

2.1.3 Special Training Requirements and Certification

Training or certification requirements for sampling personnel shall be in accordance with the requirements specified in the *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD), Vol. 1, "Administrative Requirements" (DOE-RL 1998).

Field personnel will typically have completed the following training before starting work:

- Occupational Safety and Health Administration 40-Hour Hazardous Waste Worker Training
- 8-Hour Hazardous Waste Worker Refresher Training (as required)
- Radiation Worker II Training
- Hanford General Employee Training.

2.1.4 Documentation and Records

Field sampling documentation will be in accordance with HASQARD, Vol. 2, "Sampling Technical Requirements" (DOE-RL 1998), and shall be kept in accordance with DFSNW-SSPM-001, *Sampling Services Procedure Manual* (or equivalent), including the following procedures:

- Procedure 1-1, "Chain of Custody/Sample Analysis Request"
- Procedure 1-5, "Logbooks."

Laboratory analytical documentation will be in accordance with the *Statement of Work for Environmental and Waste Characterization Analytical Services* (RFS 1999) for groundwater sampling. Overall project documentation will be in accordance with the FH procedures standards-based management system.

2.2 DATA/MEASUREMENT ACQUISITION

The following subsections present the requirements for sampling methods, sample handling and custody, analytical methods, and field and laboratory quality control (QC). The requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed.

2.2.1 Sampling Methods Requirements

The procedures to be implemented in the field should be in accordance with those outlined in HASQARD, Vol. 2, "Sampling Technical Requirements" (DOE-RL 1998), and/or DFSNW-SSPM-001 (or equivalent), as listed in Section 3.4 of this SAP.

2.2.2 Sampling Identification

A sample and data-tracking database will be used to track the samples from the point of collection through the laboratory analysis process. The Hanford Environmental Information System (HEIS) database is the repository for laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project. The HEIS numbers are to be carried through the laboratory data-tracking system.

2.2.3 Sample Handling, Shipping, and Custody Requirements

All sample handling, shipping, and custody requirements will be performed in accordance with DFSNW-SSPM-001, Procedure 2-6, "Sample Packaging and Shipping," and Procedure 1-1, "Chain of Custody/Sample Analysis Request" (or equivalent).

2.2.4 Analytical Methods Requirements

Analytical parameters and methods are listed in Table 1-8. Laboratory-specific standard operating procedures for analytical methods are described in HASQARD, Vol. 4, "Laboratory Technical Requirements" (DOE-RL 1998).

2.2.5 Quality Control Requirements

The QC procedures described in HASQARD, Vol. 2, "Sampling Technical Requirements," and Vol. 3, "Field Analytical Technical Requirements" (DOE-RL 1998), must be followed in the

field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care should be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity.

Table 2-1 lists the field QC requirements for sampling. If only disposable equipment is used or equipment is dedicated to a particular well, then an equipment rinsate blank is not required. If no volatile organic compound samples are collected, then a field transfer blank is not required. Field transfer blanks are not required when simply transferring samples to the field gas chromatograph for analysis.

Laboratory QC sample requirements are specified in the laboratory *Statement of Work for Environmental and Waste Characterization Analytical Services* (RFS 1999).

Table 2-1. Field Quality Control Requirements.

Sample Type	Frequency	Purpose
Duplicate	5% (1 sample in 20)	To check the precision of the laboratory analyses.
Equipment rinsate	One per 10 well trips	To check the effectiveness of the decontamination process.
Field transfer blank	One per day when volatile organics are sampled	To check for contamination during transport.

2.2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All onsite environmental instruments shall be tested, inspected, and maintained in accordance with DFSNW-SSPM-001, Procedure 6-1, "Control of Monitoring Instruments" (or equivalent). The results from all testing, inspection, and maintenance activities shall be recorded in a bound logbook in accordance with procedures outlined in DFSNW-SSPM-001, Procedure 1-5, "Logbooks" (or equivalent).

2.2.7 Instrument Calibration and Frequency

All onsite environmental instruments shall be calibrated in accordance with DFSNW-SSPM-001, Procedure 6-1, "Control of Monitoring Instruments" (or equivalent). The results from all instrument calibration activities shall be recorded in a bound logbook in accordance with procedures outlined in DFSNW-SSPM-001, Procedure 1-5, "Logbooks." Tags will be attached to all field screening and onsite analytical instruments, noting the date when the instrument was last calibrated and the calibration expiration date.

2.2.8 Inspection/Acceptance Requirements for Supplies and Consumables

All subject activities shall meet requirements of HASQARD, Vol. 1, "Administrative Requirements" (DOE-RL 1998). The lot number from the manufacturer-certified, pre-cleaned sample containers shall be recorded in the sampler's logbook.

2.2.9 Data Management

Data resulting from the implementation of this SAP will be stored in the HEIS database. All reports and supporting analytical data packages will be subject to final technical review by qualified reviewers before submittal to the regulatory agencies or inclusion in reports or

technical memoranda. Electronic data access, when appropriate, shall be through computerized databases (e.g., HEIS). Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 2003).

2.2.10 Sample Preservation, Containers, and Holding Times

Sample preservation, container, and holding time requirements will be prepared for specific sample events as specified on the sampling authorization forms and chain-of-custody forms in accordance with the requirements specified in RFS (1999) and the specific analytical method.

2.2.11 Field Documentation

Field documentation shall be kept in accordance with HASQARD, Vol. 2, "Sampling Technical Requirements" (DOE-RL 1998), and DFSNW-SSPM-001 (or equivalent), including the following procedures:

- Procedure 1-1, "Chain of Custody/Sample Analysis Request"
- Procedure 1-5, "Logbooks."

2.3 ASSESSMENT/OVERSIGHT

2.3.1 Assessments and Response Action

The FH Compliance and Quality Programs group may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, the project quality management plan, procedures, and regulatory requirements.

Deficiencies identified during these assessments shall be reported to the FH 200 Area Task Lead. When appropriate, corrective actions will be taken by the project engineer in accordance with HASQARD, Vol. 1, Section 4.0 (DOE-RL 1998) to minimize recurrence.

2.3.2 Reports to Management

Management shall be made aware of all deficiencies identified by self-assessments. Identified deficiencies shall be reported to the FH 200 Area Task Lead.

2.4 DATA REVIEW, VERIFICATION, VALIDATION, AND USABILITY REQUIREMENTS

2.4.1 Data Verification and Usability Methods

Data review and verification are performed by the laboratory to confirm that sampling and chain-of-custody documentation are complete. This review shall include tying sample numbers to specific sampling location, reviewing sample collection dates and sample preparation and analysis dates to assess whether or not holding times have been met, and reviewing QC data to determine whether analyses met the data quality requirements specified in this SAP.

All data verification and usability assessments shall be performed in accordance with HASQARD, Vol. 4, "Laboratory Technical Requirements" (DOE-RL 1998).

2.4.2 Data Validation

Data validation is performed either by an independent third party not involved in sampling, analysis, or assessment; or by the Waste Disposal/Groundwater Remediation Projects; or by Pacific Northwest National Laboratory using the procedures cited in the next paragraph, or equivalent. *Data Validation Procedure for Chemical Analysis* (BHI 2000a) for chemical methods and *Data Validation Procedure for Radiochemical Analysis* (BHI 2000b) for radiochemical methods will be used to perform validation. Five percent of the results will undergo Level C validation, as defined by these validation procedures.

2.4.3 Data Quality Assessment

Data quality will be assessed based on trends of concentration in wells over time. As appropriate, the data quality assessment may include the statistical approaches identified in *Washington Administrative Code* (WAC) 173-340-720(4) for groundwater monitoring.

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3.0 FIELD SAMPLING PLAN

3.1 SAMPLING OBJECTIVES

The objective of the field sampling plan is to clearly identify project sampling and analysis activities. The field sampling plan uses the sampling design identified during the DQO process and presents the design primarily using figures and tables whenever possible to identify sampling locations, the total number of samples to be collected, sampling procedures to be implemented, analyses to be performed, and sample bottle requirements.

3.2 SAMPLING LOCATIONS AND FREQUENCY

The purpose of this section is to identify the location of any new groundwater monitoring wells to be installed and to define the sampling and analysis requirements for media samples and measurements to be collected from each of these wells. The plate map provided in Appendix A shows the location of the five proposed new groundwater wells. These five new wells will all be constructed using 6-in.-diameter (or larger) casing so they could at some time be converted into extraction wells. Table 1-6 summarizes the number and location of the new wells to be installed and the sampling and analyses requirements for groundwater samples collected from these wells.

3.3 WELL DRILLING PROCEDURES

Well drilling will be performed in accordance with CP-GPP-EE-02-14.0, "Drilling, Maintaining, Remediating, and Decommissioning Resource Protection Wells, Geoprobe, and Geotechnical Soil Borings," and WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

3.4 SAMPLING PROCEDURES

The procedures to be implemented in the field should be in accordance with those outlined in DFSNW-SSPM-001 (or equivalent), including the following:

- Procedure 1-1, "Chain of Custody/Sample Analysis Request"
- Procedure 1-2, "Project and Sample Identification for Sampling Services"
- Procedure 1-5, "Field Logbooks"
- Procedure 2-5, "Laboratory Cleaning of Sampling Equipment"
- Procedure 2-6, "Sample Packaging and Shipping"
- Procedure 3-1, "Groundwater Sampling"
- Procedure 6-1, "Control of Monitoring Instruments"
- Procedure 6-2, "Turbidity Measurements"
- Procedure 6-3, "pH Measurements"
- Procedure 6-5, "Field Analysis of Conductivity using the YSI Model 30 Conductivity/ Salinity and Temperature Meter"
- Procedure 6-7, "Temperature."

Purgewater management shall be implemented in accordance with FH procedure CP-GPP-EE-01-1.11, "Purgewater Management."

3.5 SAMPLE MANAGEMENT

Sample and data management activities will be performed in accordance with FH's *Project Hanford Quality Assurance Program Description* (HNF-MP-599) and bluesheeted BHI-QA-03, *Quality Assurance Program Plans*, Plan No. 5.1, "Field Sampling Quality Assurance Program Plan," or subsequent and equivalent FH quality assurance program plans.

Sample preservation, container, and holding-time requirements will be specified on sampling authorization forms and chain-of-custody forms in accordance with the requirements specified in RFS (1999) (or equivalent) and the specific analytical method prepared for specific sample events.

3.5.1 Sample Custody

All samples obtained during the project will be controlled from the point of origin to the analytical laboratory, as required by HASQARD, Vol. 2, "Sampling Technical Requirements" (DOE-RL 1998), and DFSNW-SSPM-001, Procedure 1-1, "Chain of Custody/Sample Analysis Request" (or equivalent).

3.5.2 Sample Packaging and Shipping / Field Documentation

Sample custody during laboratory analysis will be addressed in the applicable laboratory's standard operating procedures. Sample preservation and container details will be addressed on the sampling authorization form and chain-of-custody form in accordance with the requirements specified in HASQARD, Vol. 4, "Laboratory Technical Requirements" (DOE-RL 1998); RFS (1999) (or equivalent); and analytical method requirements.

3.6 MANAGEMENT OF WASTE

The FH waste management procedures HNF-PRO-455, *Solid Waste Management*, and HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria* (FH 2003c) (as required), address the management of waste.

Waste generated by sampling activities will be managed in accordance with an established waste management plan and the requirements of DFSNW-SSPM-001 (or equivalent). Investigation-derived wasted from these sampling activities will be handled as CERCLA waste. Unused samples and associated laboratory waste for the analysis will be dispositioned in accordance with the laboratory contract and agreements for return to the Hanford Site. In accordance with DFSNW-SSPM-001 and 40 *Code of Federal Regulations* (CFR) 300.440, Remedial Project Manager approval is required before returning unused samples or waste from offsite laboratories.

The *Waste Management Plan for the Expedited Response Action for 200 West Area Carbon Tetrachloride Plume and the 200-ZP-1 and 200-PW-1 Operable Units* (DOE-RL 2005) has been prepared. The waste management plan establishes the requirements for management and disposal of waste generated from groundwater wells that are used to monitor the 200-ZP-1 OU, as required by the *Declaration of the Interim Record of Decision for the 200-ZP-1 Operable Unit* (EPA et al. 1995).

The waste management plan (DOE-RL 2005) has been updated to address wastes that may be generated during the implementation of this SAP.

3.7 WELL DECOMMISSIONING

Wells requiring decommissioning will be identified and prioritized on an annual basis. These wells will be decommissioned in accordance with WAC 173-160.

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4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with FH's (or its approved subcontractor's) health and safety plan (or equivalent), and the requirements of the most recent Waste Management Project radiological control procedures (or equivalent). Where necessary, a work planning package will include a job hazard analysis and/or site-specific health and safety plan, and applicable radiological work permits, as appropriate. The job hazard analysis has been and may continue to be used for ongoing sampling activities that are already underway. However, with more extensive work performed (e.g., drilling), a site-specific plan is currently being written.

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5.0 REFERENCES

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APPENDIX A

PLATE MAP

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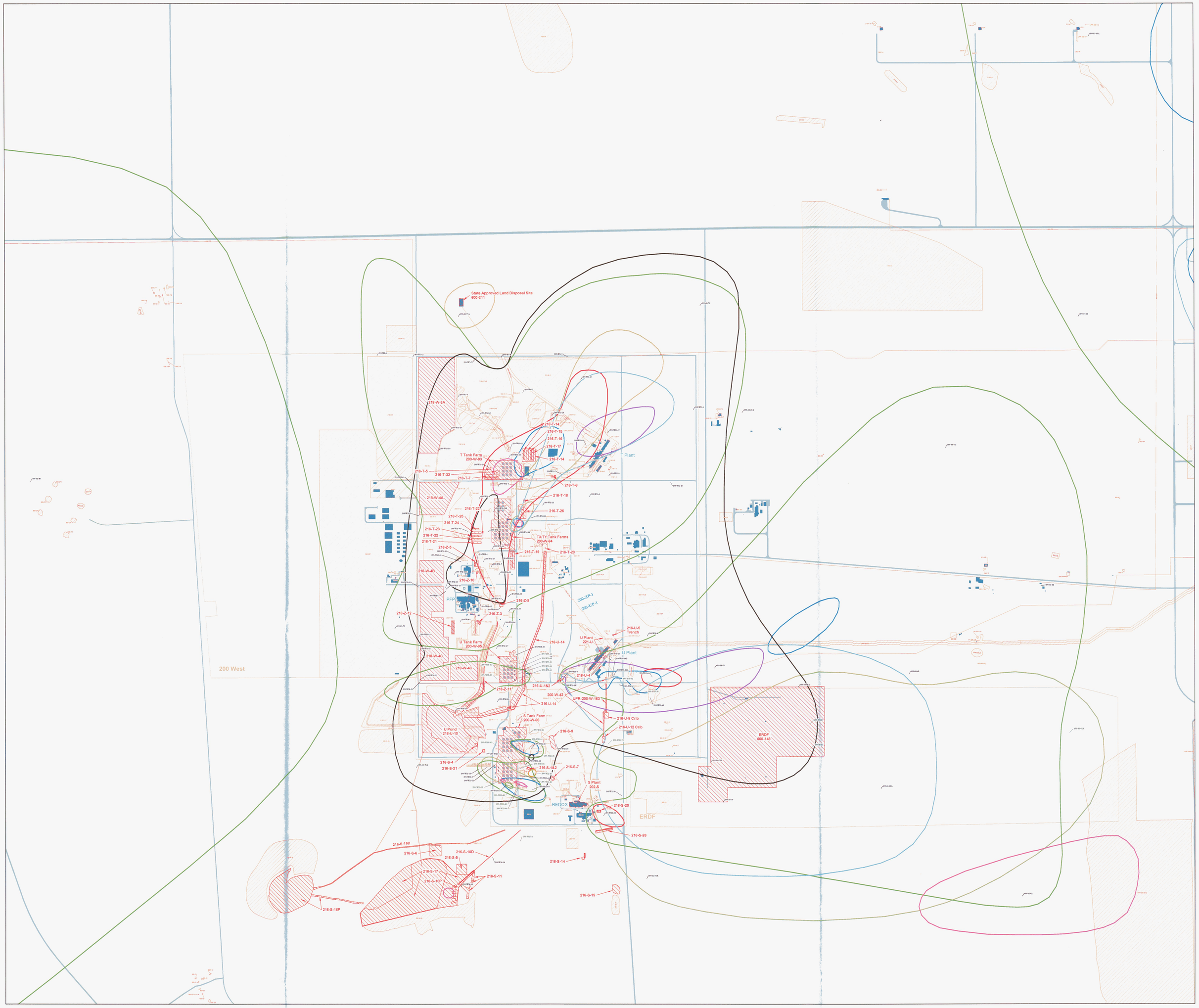
Proposed 200-UP-1 and 200-ZP-1 Monitoring Network

- Proposed New Monitoring Well in Vicinity of Old Laundry Facility and T Plant
- Other Proposed New Monitoring Well
- Proposed Monitoring Well At Known Coordinates
- Existing Monitoring Well
- Existing Extraction Well
- RCRA Monitoring Well
- Operable Unit Boundary
- Associated Waste Site
- Other Waste Site

2004 Sample Data

- Chromium Concentrations 100 ug/L
- Carbon Tetrachloride Concentrations 5 and 2000 ug/L
- Iodine-129 Concentrations 1 pCi/L
- Nitrate Concentrations 20 mg/L
- Strontium 90 Concentrations 8 pCi/L
- Technetium-99 Concentrations 900 pCi/L
- Trichloroethylene Concentrations 5 ug/L
- Tritium Concentrations 20,000 pCi/L
- Uranium Concentrations 30 ug/L



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